

CLAIMS

1. A device linkage control apparatus that controls a plurality of devices in linkage with each other, comprising:

5 a life data accumulation unit operable to generate life data by detecting usage of the devices in a user's daily life, and accumulate the generated life data, the life data indicating said usage;

10 a life pattern information generation unit operable to i) identify two or more devices from among the plurality of devices based on the accumulated life data, and ii) generate life pattern information indicating the identified two or more devices, said two or more devices being used together or in conjunction with each other in the user's daily life; and

15 a control unit operable to control the two or more devices indicated in the generated life pattern information, in linkage with each other.

2. The device linkage control apparatus according to Claim 1,

wherein the life pattern information generation unit includes:

20 an episode creation unit operable to create, based on the life data, a plurality of episode data, each of which is a collection of two or more of element data that respectively correspond to the plurality of devices;

25 an episode analysis unit operable to structuralize a co-occurrence relationship between two or more element data respectively included in the episode data; and

a life pattern interpretation unit operable to generate the life pattern information based on the structuralized co-occurrence relationship.

30 3. The device linkage control apparatus according to Claim 2,
wherein the episode creation unit creates the plurality of episode data, based on previously stored episode data creation

rules, by gathering the element data included in the respective life data accumulated by the life data accumulation unit.

4. The device linkage control apparatus according to Claim 2,

5 wherein the episode analysis unit structuralizes the co-occurrence relationship by representing, as a frequent pattern tree, an appearance frequency and a combination pattern of the element data included in the plurality of episode data created by the episode creation unit, the frequent pattern tree associating, in each
10 node, a type of the element data and a frequency which indicates said appearance frequency.

5. The device linkage control apparatus according to Claim 4,

wherein the episode analysis unit includes:

15 a frequency derivation unit operable to calculate the frequency of each element data included in the plurality of episode data;

20 a sorting unit operable to rearrange the element data within each of the plurality of episode data, in a decreasing order of frequency; and

25 a frequent pattern tree generation unit operable to generate, with regard to the plurality of episode data, the frequent pattern tree by sequentially retrieving the element data, and placing the retrieved element data as new nodes in the frequent pattern tree, or incrementing the frequency of an existing node.

6. The device linkage control apparatus according to Claim 4,

wherein the life pattern interpretation unit generates, as the life pattern information, information indicating a combination of
30 devices corresponding to nodes that are in a parent-offspring relationship in the frequent pattern tree.

7. The device linkage control apparatus according to Claim 6,
wherein the life pattern interpretation unit includes:
a node detection unit operable to detect a current node in the
frequent pattern tree;
- 5 a parent node detection unit operable to detect all nodes that
are parent nodes of the detected node; and
a life pattern output unit operable to output, as the life
pattern information, information indicating that a device
corresponding to the detected parent node and a device
10 corresponding to the current node are in a co-occurrence
relationship.
8. The device linkage control apparatus according to Claim 4,
wherein, with regard to all nodes that are roots of subtrees,
15 the episode analysis unit constructs the frequent pattern tree with a
structure in which element data having the highest frequency
becomes a root of a subtree.
9. The device linkage control apparatus according to Claim 8,
20 wherein the episode analysis unit includes:
a frequency derivation unit operable to calculate the
frequency of each element data included in the plurality of episode
data;
a sorting unit operable to rearrange the element data within
25 the each of the plurality of episode data, in a decreasing order of
frequency;
a frequent pattern tree generation unit operable to generate,
with regard to the plurality of episode data, the frequent pattern
tree by sequentially retrieving the element data, and placing the
30 retrieved element data as new nodes in the frequent pattern tree, or
incrementing the frequency of an existing node;
a subtree extraction unit operable to separate the generated

- frequent pattern tree into subtrees having, as new roots, nodes which are offspring of the root of the frequent pattern tree;
- an episode re-creation unit operable to create episode data from the separated subtrees;
- 5 a reconstruction unit operable to reconstruct the subtrees by repeating, on the created episode data, the calculation by the frequency derivation unit, the rearrangement by the sorting unit, and the frequent pattern tree generation by the frequent pattern tree generation unit; and
- 10 a subtree combining unit operable to combine the reconstructed subtrees to the original pattern tree.
10. The device linkage control apparatus according to Claim 8, wherein the episode analysis unit includes:
- 15 an input episode data storage unit operable to store, as input episode data, the plurality of episode data created by the episode creation unit;
- 20 an input episode number determination unit operable to obtain a number of the input episode data stored in the input episode data storage unit;
- 25 a most-frequent element identification unit operable to identify the element data with the highest frequency from within each input episode data;
- 30 a most-frequent element extraction unit operable to extract the element data with the highest frequency from within each input episode data, and add the extracted element data to output episode data;
- an output episode data storage unit operable to store the output episode data;
- an input episode classification unit operable to classify the input episode data according to the type of the element data; and
- a frequent pattern tree generation unit operable to generate

the frequent pattern tree that associates, in respective nodes, the appearance frequency and combination pattern of the element data with the type of the element data and the frequency which indicates said appearance frequency, the element data being included in the
5 output episode data stored in the output episode data storage unit.

11. The device linkage control apparatus according to Claim 2,
wherein the episode creation unit creates element data
respectively indicating a device and the usage time of the device
10 based on the life data, and creates, in the case where the usage
times of the respective element data have a fixed inclusive
relationship or an overlapping relationship, episode data that
includes said respective element data.

15 12. The device linkage control apparatus according to Claim 2,
wherein the episode creation unit creates, based on the life
data, event data respectively indicating a device, an event occurring
with the device, and an occurrence time of the event, and creates, in
the case where the occurrence times of the respective event data
20 have a fixed inclusive relationship or an overlapping relationship,
episode data including element data corresponding to the devices
indicated by said respective event data.

25 13. The device linkage control apparatus according to Claim 6,
wherein the life pattern interpretation unit calculates, for
each of the nodes that are in the parent-offspring relationship in the
frequent pattern tree, a confidence level indicating a degree of the
co-occurrence relationship, and generates the life pattern
information with only the nodes that are connected with a
30 confidence level that is equal to or higher than a fixed value.

14. The device linkage control apparatus according to Claim 1,

wherein, in the case where it is detected that a state of a first device indicated in the life pattern information has changed, the control unit causes a state of a second device indicated in the life pattern information to change by controlling the second device.

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15. The device linkage control apparatus according to Claim 14, wherein a first and a second device respectively include a timer, and

10 in the case where it is detected that setting details of the timer included in the first device is changed, the control unit changes setting details of the timer included in the second device.

15. The device linkage control apparatus according to Claim 15, wherein, in the case where it is detected that a setting of a preset time of the timer included in the first device is changed, the control unit changes a setting of a preset time of the timer included in the second device in such a way that a difference between the times before changing and the times after changing is the same.

20 17. The device linkage control apparatus according to Claim 14, wherein, in the case where it is detected that the state of the first device indicated in the life pattern information has changed, the control unit i) previously generates and records change information indicating that the state of the second device indicated in the life pattern information should be changed, and ii) causes the state of the second device to change by controlling the second device according to the change information after a predetermined time elapses.

30 18. The device linkage control apparatus according to Claim 17, wherein the first and the second devices respectively include a timer, and

in the case where it is detected that setting details of the timer included in the first device is changed, the control unit i) previously generates and records change information that includes an instruction to change the setting details of the timer included in
5 the second device and a designation for a time for said change, and ii) changes the setting details of the timer included in the second device according to the change information when said time comes.

19. The device linkage control apparatus according to Claim 14,
10 wherein the control unit previously stores a plurality of linkage information identifying details of the control and selection condition information indicating conditions for selecting one linkage information from among the plurality of linkage information; and in the case where it is detected that the state of the first device
15 indicated in the life pattern information has changed, the control unit selects one of the plurality of linkage information by referring to the selection condition information, and causes the state of the second device indicated in the life pattern information to change, by controlling the second device according to the selected linkage
20 information.

20. The device linkage control apparatus according to Claim 19,
25 wherein the linkage information indicates a difference between preset times of timers included in the first and second devices,

the selection condition information indicates a correspondence of a setting value of the preset time of the timer included in the first device and the linkage information that needs to be selected, and

30 in the case where it is detected that setting details of the preset time of the timer included in the first device is changed, the control unit selects one linkage information corresponding to the

changed preset time from among the plurality of linkage information by referring to the selection condition information, and changes the preset time of the timer included in the second device according to the selected linkage information.

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21. The device linkage control apparatus according to Claim 14, wherein the first and the second devices respectively include a timer, and

10 in the case where it is detected that setting details of the timer included in the first device is cancelled, the control unit cancels the setting details of the timer included in the second device.

15 22. The device linkage control apparatus according to Claim 14, wherein the first and the second devices respectively include a timer, and

20 in the case where it is detected that setting details of the timer included in the first device is changed, the control unit causes the second device to make a sound output or a display output by controlling the second device, said output indicating that said setting details is changed.

23. A device linkage control method for controlling a plurality of devices in linkage with each other, comprising:

25 a life data accumulating step of generating life data by detecting usage of the devices in a user's daily life, and accumulating the generated life data, the life data indicating said usage;

30 a life pattern information generating step of i) identifying two or more devices from among the plurality of devices based on the accumulated life data, and ii) generating life pattern information indicating the identified two or more devices, said two or more

devices being used together or in conjunction with each other in the user's daily life; and

a control step of controlling the two or more devices indicated in the generated life pattern information, in linkage with each other.

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24. A program for an apparatus that controls a plurality of devices in linkage with each other, comprising:

a life data accumulating step of generating life data by detecting usage of the devices in a user's daily life, and
10 accumulating the generated life data, the life data indicating said usage;

a life pattern information generating step of i) identifying two or more devices from among the plurality of devices based on the accumulated life data, and ii) generating life pattern information
15 indicating the identified two or more devices, said two or more devices being used together or in conjunction with each other in the user's daily life; and

a control step of controlling the two or more devices indicated in the generated life pattern information, in linkage with each other.

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25. A device linkage control system comprising a plurality of devices and a control apparatus that are connected to each other by a transmission line, the control apparatus controlling the plurality of devices in linkage with each other,

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wherein the control apparatus includes:

a life data accumulation unit operable to generate life data by detecting usage of the devices in a user's daily life, and accumulate the generated life data, the life data indicating said usage;

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a life pattern information generation unit operable to i) identify two or more devices from among the plurality of devices based on the accumulated life data, and ii) generate life pattern information indicating the identified two or more devices, said two

or more devices being used together or in conjunction with each other in the user's daily life; and

5 a control unit operable to control the two or more devices indicated in the generated life pattern information, in linkage with each other;

10 26. A life pattern information generating apparatus that generates life pattern information for a device linkage control apparatus that controls a plurality of devices in linkage with each other based on the life pattern information, the life pattern information generating apparatus comprising:

15 a life data accumulation unit operable to generate life data by detecting usage of the devices in a user's daily life, and accumulate the generated life data, the life data indicating said usage; and

20 15 a generation unit operable to i) identify two or more devices from among the plurality of devices based on the accumulated life data, and ii) generate life pattern information indicating the identified two or more devices, said two or more devices being used together or in conjunction with each other in the user's daily life.

25 27. The life pattern information generating apparatus according to Claim 26,

30 wherein the generation unit includes:

25 an episode creation unit operable to create, based on the life data, a plurality of episode data, each of which is a collection of two or more of element data that respectively correspond to the plurality of devices;

30 an episode analysis unit operable to structuralize a co-occurrence relationship between two or more element data respectively included in the episode data; and

35 a life pattern interpretation unit operable to generate the life pattern information based on the structuralized co-occurrence

relationship.

28. A life pattern information generation method for generating life pattern information for a device linkage control apparatus that controls a plurality of devices in linkage with each other based on the life pattern information, the method comprising:

5 a life data accumulating step of generating life data by detecting usage of the devices in a user's daily life, and accumulating the generated life data, the life data indicating said 10 usage; and

10 a generating step of i) identifying two or more devices from among the plurality of devices based on the accumulated life data, and ii) generating life pattern information indicating the identified two or more devices, said two or more devices being used together 15 or in conjunction with each other in the user's daily life.

29. A program for generating life pattern information for a device linkage control apparatus that controls a plurality of devices in linkage with each other based on the life information, the program comprising:

20 a life data accumulating step of generating life data by detecting usage of the devices in a user's daily life, and accumulating the generated life data, the life data indicating said usage; and

25 a generating step of i) identifying two or more devices from among the plurality of devices based on the accumulated life data, and ii) generating life pattern information indicating the identified two or more devices, said two or more devices being used together or in conjunction with each other in the user's daily life.

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30. A device linkage control apparatus that controls a plurality of devices in linkage with one another, which is used by being

connected to a life data accumulating apparatus that accumulates life data indicating usage of the plurality of devices in a user's daily life, the device linkage control apparatus comprising:

a life pattern information generation unit operable to i) identify two or more devices from among the plurality of devices based on the life data accumulated by the life data accumulating apparatus, and ii) generate life pattern information indicating the identified two or more devices, said two or more devices being used together or in conjunction with each other in the user's daily life;

10 and

a control unit operable to control the two or more devices indicated in the generated life pattern information, in linkage with each other.

15 31. A life pattern information generating apparatus that generates life pattern information for a device linkage control apparatus controlling a plurality of devices in linkage with each other based on the life pattern information, the life pattern information generating apparatus being used by being connected to
20 a life data accumulating apparatus that accumulates life data indicating usage of a plurality of devices in a user's daily life, and comprises

a generation unit operable to i) identify two or more devices from among the plurality of devices based on the life data accumulated by the life data accumulating apparatus, and ii) generate life pattern information indicating the identified two or more devices, said two or more devices being used together or in conjunction with each other in the user's daily life.